Nanoscale Chemistry in One-dimension

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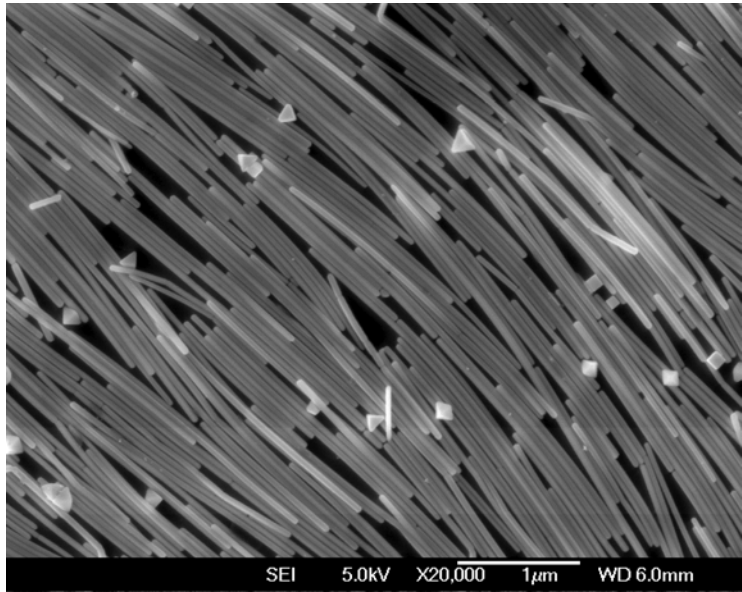
NSF-CAREER DMR-0092086

Significant progress has been made in the area of nanowire synthesis and device application in the past several years. A grand challenge, however, still resides in the hierarchical organization of these nanoscale building blocks into functional assemblies and ultimately a useful system. Successful alignment and patterning of nanowires would significantly impact many areas such as nanoscale electronics, optoelectronics and molecular sensing. Herein, we report our successful attempt to utilize Langmuir-Blodgett process to assemble aligned monolayers of silver nanowires. The resulting nanowire monolayers can serve as excellent surface enhanced Raman Spectroscopy substrates, and can readily be used in ultrasensitive, molecular-specific sensing utilizing vibrational signatures.



Wires on water
Nature, 425, 243, 2003.
Nano. Lett. 3, 1229, 2003.

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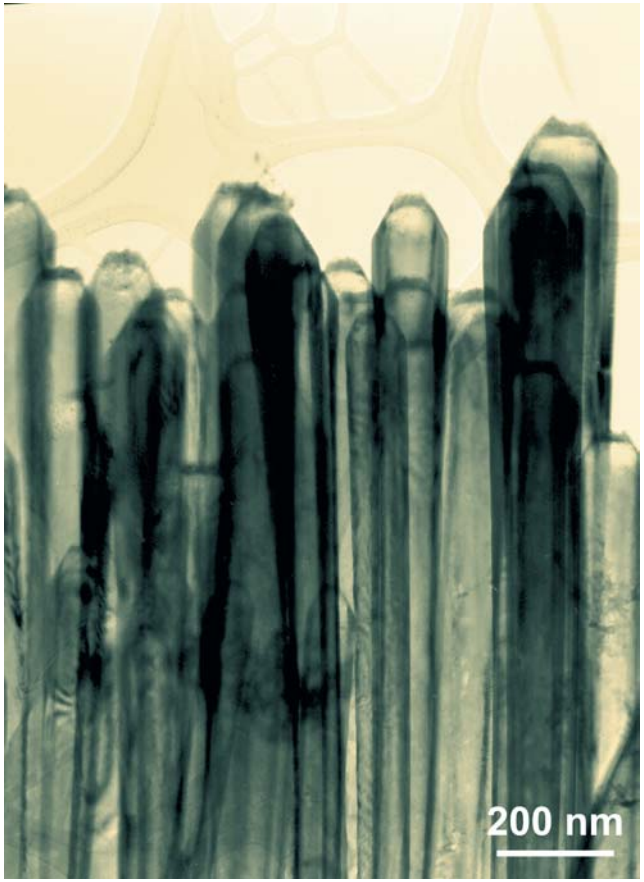
The growth of single crystalline semiconductor nanotubes would be advantageous in potential nanoscale electronics, optoelectronics, and biochemical sensing applications. We've developed an "epitaxial casting" approach for the synthesis of single crystalline technologically important GaN nanotubes with inner diameters of 30-200 nm and wall thicknesses of 5-50 nm. Hexagonal ZnO nanowires were used as templates for the epitaxial overgrowth of thin GaN layers in a chemical vapor deposition system. The ZnO nanowire templates were subsequently removed by simple thermal reduction and evaporation, resulting in ordered arrays of GaN nanotubes on the substrates. This is the first example of single crystalline GaN nanotubes and the novel templating process should be applicable to many other semiconductor systems.



Single Crystalline GaN Nanotubes
Nature, 422, 599, 2003.